LAND APPLICATION of SEWAGE SLUDGE and BIOSOLIDS

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Preface

As indicated in Chapter 1 of this book, land application of sewage sludge and biosolids has been practiced for centuries. Over the past 40 years, I have been involved in various aspects of organic matter and soils. Since 1972, I have researched, studied, and published on various aspects of biosolids management, concentrating on composting and the public health aspects of land application. I have been an active member on the Water Environment Federation Residuals Committee and The U.S. Composting Council Board of Directors. In 1977, I published a book titled *The Science of Composting*.

It was very difficult to write the present book because the literature on this subject is enormous. I reviewed more than 4000 references during the year that it took me to write it, and cited more than 570 references. The interest and concerns of scientists throughout the world not only indicate the importance of the subject, but also show the dedication to disseminating information related to health and the environment. It is very evident that the majority of the scientific community think that the management and use of biosolids in a sound manner is proper and environmentally safe.

My objective in writing this book was to provide the reader with insights into the scientific writings and findings. Those who are interested in more detail can delve into the cited works to obtain more information.

One of the major aspects of land application of biosolids is the issue of risk to humans, animals, plants and the environment. The two major categories of risk are (1) voluntary and (2) imposed. People who smoke cigarettes do so voluntarily, even though they are aware of the risk. The same applies to driving a car or flying. These are all voluntary risks. However, we often do not have choices, but have a risk imposed upon us. The placement of nuclear power plants near communities is such an imposed risk. The most important issue related to imposed risks is how serious or great they are. We do not live in a risk-free society. The risk and vulnerability clearly impacted all of us on September 11, 2001. Consider the risk of using biosolids on human health and the environment in light of the following:

- The risk from contaminated food by *E. coli* O157:H7, which has resulted in numerous deaths and contamination of food by *Salmonella* sp. and other bacteria.
- The risk from contaminated water, which has resulted in many persons being ill, as well as numerous deaths.
- The risk from bacteria and viruses when using home toilets (Gerba, C.P., C. Wallis, and J.L. Melnick, 1975. Microbial hazards of household toilets: Droplet production and the fate of residual organism. *Applied Microbiol*ogy 30(2):229-237).
- The risk of ingesting fish contaminated with mercury, as compared with ingesting mercury from biosolids-contaminated food.
- The risk of indoor air pollution from volatile organic compounds in carpets, paints, household cleaners, etc.
- The risk of bioaerosols when walking through the park or visiting a farm, as compared with the potential risk from bioaerosols from an outdoor composting facility.
- The risk of a Staphylococcus infection or infection by *Aspergillus fumigatus* in a hospital.

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It is important to put the use of biosolids into the proper risk perspective. Biosolids can be disposed of only in the soil, water or air. The greatest advantages to land application are that we can control our activities and manage them. Once a contaminant is in the water or air, it is very difficult to control it. Our biosolids control and management practices need to be consistent with good scientific knowledge and judgment. It is the duty of the scientist to seek out the truth and to provide the engineer and biosolids manager with the knowledge and direction of how best to protect the health of humans, animals, plants and the environment. I hope this book will shed some light on the degree of potential risk from applying biosolids to land.

I would like to repeat my quotation from Berth Damon cited in my earlier book. It is also appropriate for land application of biosolids, as the organic matter will eventually turn into humus.

> To consider *humus* is to get a hint of the oneness of the universe. All flesh is grass, in more than the figurative sense the prophet intended. During the long history of this planet, weather has disintegrated rock, tiny lichens have made a speck of vegetable mold, countless generations of short-lived weeds have waxed fat for summer, giant forests have flourished for an aeon, and all in turn have died and given back to the earth more goodness than they have taken from it. All have been composted into humus. And the life of insects and of animals and of men which was sustained upon the life of these plants and upon the life of other animals, all these creatures too have enriched the surface of the earth with their excreta and finally with their bodies. All in turn have been composted into humus.

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My greatest thanks and appreciation go to my family. They have provided me with inspiration, support and encouragement throughout the entire process. My wife, Esther, deserves special thanks for the considerable time she spent proofreading the manuscript, contacting firms for permission to use material, and many other tasks throughout the process.

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Eliot Epstein is Chief Environmental Scientist for Tetra Tech, Inc. and an adjunct professor of public health at Boston University School of Public Health at the School of Medicine. He received his B.S. degree in Forestry from New York College of Forestry at Syracuse University, an M.S. degree in Agronomy from the University of Massachusetts, and a Ph.D. in soil physics from Purdue University. For 16 years he was a research leader for the U.S. Department of Agriculture's Agricultural Research Service and an adjunct professor of soil physics at the University of Maine. His research there concentrated on soil erosion and runoff and soil water relations of plants.

In 1972, Dr. Epstein transferred to the USDA ARS research center in Beltsville, Maryland, where he conducted research on the use of biosolids, and where, in 1975, he researched and developed the aerated static pile method (ASP). In 1980, he became president of E&A Environmental Consultants, Inc., a premier company in composting and beneficial use of organic materials. In that capacity, he was the principal-in-charge of numerous projects conducted by the staff located in Massachusetts, North Carolina, and Washington State.

Dr. Epstein has more than 30 years of experience in biosolids composting, and has managed or directed more than 400 composting projects in the United States, Canada and Europe. He consulted on composting and biosolids management for the US EPA, World Bank and United Nations. In 2001, Dr. Epstein and his staff joined Tetra Tech, Inc., a leading company in water reuse, wastewater and beneficial use of organic residues.

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